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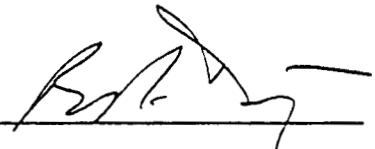
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MEMORANDUM

To: T.C. Greengard
From: B.P. Doty
Date: May 16, 1988

Subject: Metals in Ground Water
881 Hillside



The March 1, 1988, Remedial Investigation Report for the 881 Hillside discusses metal and radiometric contamination of shallow ground water. These discussions are summarized below for each of the two sites (SWMUs 103/106/107 and 119.1)

SWMU 103/106/107

Based on data and discussions presented in the report, the metals and radionuclides of concern are selenium, strontium and total uranium.

Selenium

Selenium was only detected in samples from the shallow and uppermost bedrock ground water at the three well cluster (69-86, 59-86BR and 8-87BR) at concentrations ranging from 0.1 to 0.2 milligrams per liter (mg/l).

Selenium was not detectable in either shallow or bedrock background samples (0.005 and 0.002 mg/l, respectively).

Based on information presented in the discussion of SWMU 119.1, it is concluded that the selenium is probably of natural origin. This is consistent with relatively high selenium concentrations found in samples from wells in the Golden area by Moran (1976).

Strontium

Strontium was detected in samples from all of the wells in the range of 0.4 to 1.4 mg/l.

Upgradient of the plant, strontium was found in samples at concentrations ranging from <0.02 to 0.2 mg/l and from 0.14 to

0.87 mg/l in the shallow and bedrock ground waters, respectively.

Because strontium was found in all of the samples (even in samples from bedrock wells which have demonstrably poor connection with the shallow system), it is concluded that the strontium is probably of natural origin.

Total Uranium

Total uranium was found at concentrations higher than background near the building (36 pCi/l), in the shallow ground water at the three well cluster (25 pCi/l) and in the uppermost bedrock at the three well cluster (17 pCi/l).

Background total uranium concentrations range from nondetectable to 9 pCi/l in the shallow ground water and nondetectable to 14 pCi/l in the bedrock ground water.

Although the concentrations at SWMU 103/106/107 are elevated with reference to background conditions, they do not exceed the proposed surface water standard of 40 pCi/l. Uranium is apparently being released from soils in the vicinity of the SWMU, possibly as a result of leaching by waste materials.

SMWU 119.1

Based on data and discussions presented in the report, the metals and radionuclides of concern are nickel, selenium, strontium and total uranium.

Nickel

Nickel was found in samples from all of the shallow wells at concentrations of about 0.2 mg/l. Nickel was not detected in the bedrock samples.

Nickel in background samples ranged from <0.04 to 0.07 mg/l and <0.04 mg/l in the shallow and bedrock ground-water samples, respectively.

The average nickel concentration (0.2 mg/l) is equal to the irrigation standard; there is no drinking water standard. Nickel is apparently being released from the soils, possibly as a result of leaching by waste materials.

Selenium

Selenium was found at 0.5 mg/l at the source, 0.2 mg/l at well 4-87, 0.02 mg/l at 6-87 and at 0.05 mg/l in the bedrock well at the source (5-87BR).

Selenium was not detectable in either shallow or bedrock background samples (0.005 and 0.002 mg/l, respectively).

Because well 5-87BR is in poor communication with the shallow system (large vertical gradient and lack of volatile organic contamination), it is concluded that the selenium is probably of natural origin. This is consistent with relatively high selenium concentrations found in samples from wells in the Golden area by Moran (1976).

Strontium

Strontium was found ranging from 1 to 2 mg/l in the shallow ground water and at about 3 mg/l in the bedrock ground water (5-87BR).

Upgradient of the plant, strontium was found in samples at concentrations ranging from <0.02 to 0.2 mg/l and from 0.14 to 0.87 mg/l in the shallow and bedrock ground waters, respectively.

Because the concentrations in samples from SWMU 119.1 are similar to those found at SWMU 103/106/107 and because strontium is found in both the shallow and bedrock ground-water systems which are believed to be poorly connected, it is concluded that the strontium is probably of natural origin.

Total Uranium

Total uranium was found at 37 pCi/l in shallow ground water at the source, 36 pCi/l at 4-87, 55 pCi/l at 6-87, and at 18 pCi/l at 5-87BR. Considering the uncertainties, the total uranium concentrations at 5-87BR may be equivalent to background concentrations.

Background total uranium concentrations range from nondetectable to 9 pCi/l in the shallow ground water and nondetectable to 14 pCi/l in the bedrock ground water.

Because of the poor communication between the shallow and bedrock ground-water systems and the relatively high uncertainty associated with the determination ($\pm 20\%$), it is concluded that the total uranium in the sample from 5-87BR is

probably of natural origin. However, it appears that uranium is being released from the soils, possibly as a result of leaching by waste materials.

CONCLUSIONS

The conclusions of this review are as follows.

1. Both selenium and strontium appear to be of natural origin although concentrations are elevated over the background ranges. It is hypothesized that the Arapahoe Formation (and colluvial materials derived from it) is the source of the higher selenium and strontium concentrations.
2. Nickel is apparently being released from the soils in the vicinity of SWMU 119.1 (not SWMU 103/106/107), possibly as a result of leaching by waste materials. The average nickel concentration (0.2 mg/l) is equal to the irrigation standard; there is no drinking water standard.
3. Uranium is apparently being released from soils at both SWMUs 103/106/107 and 119.1, possibly as a result of leaching by waste materials. Although the total uranium concentrations are elevated with reference to background conditions, they generally do not exceed (SWMU 103/106/107) or only slightly exceed (SWMU 119.1) the proposed surface water standard of 40 pCi/l.